NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Water Table Control

(Acre)

Code 641

DEFINITION

The water table can be control through proper use of subsurface drains, water control structures, and water conveyance facilities for the efficient removal of drainage water and distribution of irrigation water.

PURPOSES

The purpose of a Water Table Control Structure is to improve the soil environment for vegetative growth by regulating the water table to remove excess runoff and subsurface water, facilitate leaching of saline and alkali soil, and regulate or manage ground water for subirrigation.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to areas where:

1. A high water table exists, either natural or induced;

2. The topography is relatively smooth, uniform, and flat to gently sloping;

3. Subsurface conditions are such that a water table can be maintained without excessive water loss;

4. An adequate water supply is available;

5. Benefits of subirrigation, in addition to controlling ground water and surface runoff, justify installation of the system;

6. Soil depth and permeability will permit effective operation of the control system;

7. Saline or sodic soil conditions can be maintained at an acceptable level for efficient production of crops;

8. A suitable outlet exists;

9. Improvement of off-site water quality is needed and may be provided by controlling the water table.

CRITERIA

General. Designs are to be made in accordance with all other pertinent Engineering Standards such as Subsurface Drain (606); Surface Drainage, Field Ditch (607); Surface Drainage, Main or Lateral (608); Structure for Water Control (587); Irrigation System, Surface and Subsurface (443); and the additional special design criteria contained in this standard.

Capacity. The overall facilities designed and all component parts shall have the capacity to deliver or remove the flow of water required for irrigation or drainage, whichever is greater.

1. Drainage Capacity. Combined capacity of the surface and subsurface facilities shall

be adequate to satisfy the appropriate drainage coefficient for the crops to be grown.

Where it is necessary to admit surface water through surface inlets to the drain, an adjustment in the required capacity of the drain should be made if needed to compensate for increased inflow soon after rainfall.

2. Irrigation capacity. The facilities should be sized to supply the peak periods consumptive use rate for the crops to be grown. Use a maximum efficiency of 90% for soils with slowly permeable underlying layers (clay loam to clay) and maximum of 75 percent for other soils. See Indiana Irrigation Guide for consumptive use rate.

Land Preparation. Excessive irregularities in the land surface should be removed whenever practical by leveling or smoothing so that grades in the direction of the rows are level or continuous, except for minor depressions. Otherwise, surface inlets shall be provided in the depressions for surface water removal. Silt traps should be provided, as needed, depending on the type of surface inlet. From a maintenance standpoint, it is advisable to have as few surface inlets as practical. Consideration of soil profile should be given where land preparation is being considered.

Plan. A plan based on soils, topography, and crops to be grown shall be prepared. The plan shall show the location, elevations, spacing, size, and grade of all conduits, control structures, and outlet channels.

Grade of Main and Laterals. The grade of mains may be level or constantly sloping toward the outlet and may be either open ditches or closed conduits. Laterals should be planned on grades as nearly parallel to the ground surface as possible and sloping toward the normal outlet. The grade of the laterals will generally be on a grade on 0.1 percent, except a level grade may be used up to 300 feet maximum from a main. Lateral grades may be reduced to 0.05 percent if essential for effective water table control and precautions are taken to minimize sedimentation problems.

Length of Laterals. Providing adequate capacity for drainage and irrigation should be considered in planning lateral length. Lateral length may be restricted by the requirements for lateral depth relative to desired water table elevations at the upper end of individual laterals. Sloping laterals should normally not exceed 1,200 feet with 1,000 feet being the normal maximum.

Depth of Laterals. The subsurface drain should be deeper than the maximum and minimum levels of the desired water table throughout the length of the lateral. The minimum depth of cover shall normally be 24 inches in mineral soils or 30 inches in organic soils. It is desirable to place laterals within the soil layer having the highest hydraulic conductivity.

Spacing of Mains and Laterals. The spacing of main lines and open supply or drainage ditches should be as needed to enable lateral lines to adequately serve the field area. The maximum spacing of laterals to achieve uniform distribution of irrigation water will be determined by one or more of the following:

1. DRAINMOD program analysis;

2. Using 60-75 percent of the average spacing recommendation obtained from the drainage guide;

3. Comparing the subject site to existing systems with similar soils and crops, where the adequacy of the existing system is known;

4. Small trial area, where insufficient existing data are available for certain soils.

Size of Conduits. Conduits must be sized to provide the desired flow allowing for friction losses and the hydraulic gradients anticipated, for both drainage and subirrigation. The minimum size of conduits is 4 inches.

Filter and Filter Material. Because of the water movement into and out of the conduits in water table control laterals with fluctuating hydraulic heads, the potential for siltation may be greater than in regular drainage laterals. Suitable filters should be used where needed to prevent siltation (for guidance, see Engineering Field Manual p. 14-70.) Determining the need for a filter or selecting a filter is critical.

Generally, only properly graded sand and gravel filters, as defined in the Subsurface Drain standard (606), should be used as filters around conduits in water-table control systems. For coarser textured, well-graded sands, filters may not be necessary. For fine-textured, poorly graded sands, poorly graded sands, a geotextile filter material may be used. If geotextile filters are to be used in any other soils, they should be tested to prove they would function satisfactorily. These tests should be made against the soils in which the filters will be installed. These tests are necessary unless sufficient field installations are available in similar soils to indicate that these geotextile filters have not clogged under similar water-table control conditions. In soils where iron oxide problems are know to exist and a filter is needed, a knitted geotextile material or sand gravel filter should be used.

Envelopes and Envelope Material. Envelopes shall be used around subsurface drains if needed for proper bedding of the conduit or to improve the characteristics of flow of ground water into the conduit. See Subsuface Drain standard (606) for envelope material requirements.

Water Control Structures. Where the main lines are sloping; a water control structure will normally be placed in the line at no more than 1.0 foot vertical intervals.

Water control structures should be sized to provide the required drainage flow over the flashboard or otherwise through the control structure with a maximum head of 0.5 feet for normal operations. In all cases, the drainage flow elevation should be controlled so that crop damages do not occur as a result of an extended period of saturation in the root zone. Structures should be designed so that control can be quickly removed when return to the drainage mode is desired.

CONSIDERATIONS

Effects on water quantity and quality shall be considered. This practice may either increase or decrease soil water depending on the management of the system. When water is stored and used in the system, downstream discharges will decrease. Conversely, when excess water is drained from the field, downstream discharges may increase. Draining water from the field may reduce deep percolation and ground water recharge depending on the geohydrologic conditions of the site. Normally, deep percolation and ground water recharge may be induced due to the maintained water table under the appropriate geohydrologic environment. Transpiration is expected to increase due to irrigation. Evaporation may decrease when ponded surface areas are reduced by drainage.

The water table control practice reduces runoff; therefore, downstream sediment and sediment-attached substance yields will be reduced. When drainage is increased, the dissolved substances in the soil water will be discharged to receiving water and the quality of water reduced. Maintaining a high water table, especially during nongrowing season, will allow denitrification to occur and reduce the nitrate content of surface and ground water by as much as 75%. Installation of this practice may create temporary erosion and sediment yield hazards but the completed practice will lower erosion and sedimentation levels.

Special attention shall be given to maintaining and improving visual resources and habitat for fish and wildlife where applicable. The effect of the water table control of this practice on downstream wildlife communities may vary with the purpose and management of the water in the system. The landowner/user will be advised if wetlands will be affected and USDA-NRCS wetland policy will apply. All work planned shall be in compliance with General Manual Title 450-GM, Part 405, Subpart A, Compliance

with Federal, State, and Local Laws and Regulation.

Consideration shall be given to the use of construction materials, grading practices, vegetation, and other site development elements that minimize visual impact and maintain or complement existing landscape uses. All water table control measures will be planned as part of a resource management system.

PLANS AND SPECIFICATIONS

Plans and specifications for installing water table control facilities shall be in keeping with this standard and shall describe the requirements for applying all components of the facility to achieve its intended purpose. Incorporate, by reference, appropriate conservation practice standards and specifications required to install the facility.

OPERATION AND MAINTENANCE

An operation and maintenance plan should be provided to inform the owner of operation and maintenance needs.

Operation. Operation of the facilities should be such that prolonged saturation of the root zone does not occur. For very shallow rooted crops, such as vegetables, the best method of operation may be to raise the ground water to near 12 inches of the ground surface for a short period until the surface layer of the soil reaches its waterholding capacity. Once this condition is reached, the water table is then allowed to recede by evapotranspiration to some predetermined level until the crop needs to be irrigated again. Additional water is then applied and the cycle is repeated. This procedure allows air to move into the soil and plant root zone for optimum root development.

For deeper rooted crops, it is customary to maintain the water control structures at a predetermined level for the various crop stages; thus, variations in the water table will result only from rainfall and differing consumptive use rates during any particular crop stage.

Water control structures should be designed so that adjustments may be easily made to facilitate removal of large storm discharges. Trafficability in the spring and during harvest can also be facilitated by timely lowering of the water table. Flashboard type structures normally allow for adequate management of the water table.

Maintenance. Maintenance items should be addressed as appropriate for the materials and system used.